



## **IBM 1410/7010 Operating System (1410-PR-155)**

### **Basic Concepts**

This publication provides users of 1410 or 7010 Data Processing Systems with a general description of the 1410/7010 Operating System and its various components. Also included is a brief description of each manual in the set of supporting publications for the Operating System, and an outline of their relationship to each other.

The 1410/7010 Operating System is an integrated set of programs and programming systems that will provide a 1410 or 7010 installation with a convenient, efficient means of filling its data processing requirements. This Operating System will enable an installation to write, assemble and execute programs with a minimum of programmer time, machine time, and machine-operator time.

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This publication supersedes the publication **IBM 1410/7010 Operating System; Basic Concepts**, Form C28-0318 and associated Technical Newsletter N28-1079.

Copies of this and other IBM publications can be obtained through IBM Branch Offices.

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### Purpose of the Publication

This publication provides users of 1410 or 7010 Data Processing Systems with a general description of the 1410/7010 Operating System and its various components. Included are descriptions of the features of the system as a whole, the functions to be performed by the various components of the system, and the general requirements for use of the system and its components. Readers of this publication should be familiar with the principles of operation of the IBM 1410 and/or IBM 7010 Data Processing Systems (see the publications, *IBM 1410 Principles of Operation*, Form A22-0526, or *IBM 7010 Principles of Operation*, Form A22-6726) and the basic concepts of programming and programming systems.

### Purpose of the 1410/7010 Operating System

The 1410/7010 Operating System is an integrated set of programs and programming systems that will provide a 1410 or 7010 installation with a convenient and efficient means of fulfilling its data processing requirements. The 1410/7010 Operating System will enable an installation to write, assemble and execute programs with a minimum of programmer time, machine time, and machine-operator time.

### Machine Requirements

The basic machine requirements for use of most features of the 1410/7010 Operating System are shown

ITEM	REQUIREMENTS	
	Installations Using 1301 (Disk-Oriented)	Installations Not using 1301 (Tape-Oriented)
Processing Overlap and Priority Special Features <sup>1</sup>	Both Needed	Both Needed
Positions of Core Storage	60,000	40,000
IBM 1402 Card Read Punch, Model 2 <sup>2</sup>	1	1
IBM 1403 Printer, Model 2 <sup>2</sup>	1	1
IBM Magnetic Tape Units (729 II, IV, V, VI and/or 7330)	2	5
IBM 1301 Disk Storage	1	-

<sup>1</sup> These features, standard on the IBM 7010 Data Processing System, are a requirement for IBM 1410 installations using the 1410/7010 Operating System.  
<sup>2</sup> The IBM 1442 Card Reader, Model 3, or a magnetic tape unit, can be used to perform the card-read function. An additional tape unit can be used to perform the card-punch and/or print function. In any case, the card-read, card-punch and print requirements must all be satisfied.

Figure 1. Basic Machine Requirements

in Figure 1. A complete description of machine requirements — covering such features as the TELE-PROCESSING® Supervisor, specialized use of the Generalized Tape Sorting Program, multiple "Compile-and-Go" within jobs (see "Definition of Terms"), etc. — is presented in the publication, *System Generation*.

### Definition of Terms

The general terms listed below are defined for use within this publication and all publications concerned with the 1410/7010 Operating System. Terms associated with a particular component of the Operating System are defined within the publication describing that component.

**Absolute Program:** A machine-language program in a format ready for loading directly into a specific area of core storage.

**Alternate Input Unit:** An input/output unit that can be substituted for the Standard Input Unit (SIU) to permit interruption of batch processing for a high-priority job or for unscheduled diagnostic routines.

**Batch:** A collection of jobs to be performed under the supervision of the System Monitor.

**Batch Processing:** The processing of a collection of jobs by the computer without need for operator intervention between jobs.

**Compilation:** See "Processor."

**Compile-and-Go:** The compilation and subsequent execution of one or more programs within one job without need for operator intervention.

**Job:** One or more runs specified by the user to be compiled and/or executed as a logical unit without need for operator intervention.

**Master File:** The tape file, provided by IBM, containing all elements of the IBM 1410/7010 Operating System. The Master File is the source file for each installation's initial system generation run.

**Module:** See "Subprogram."

**Processor:** A machine-language program that translates source programs written in a symbolic language (i.e., Autocoder, COBOL, FORTRAN) into machine-language instructions. This process is called a *compilation*.

**Relocatable Program:** A machine-language program or subprogram in a format that allows reassignment of addresses, thus making possible its conversion into an absolute program with addresses adjusted to correspond to any available area of core storage. This

format also enables effective communication among several subprograms constituting a single, complete program.

**Run:** A major function performed by a computer, such as the execution of a compiler or an object program.

**Standard Input Unit:** A card reader or magnetic tape unit from which control information for the System Monitor and other elements of the Operating System can be read. It may also serve as the input medium for source programs or other data.

**Standard Print Unit:** A tape unit or printer specified by the user to receive printer output from programs operating within the framework of the 1410/7010 Operating System.

**Standard Punch Unit:** A tape unit or card punch specified by the user to receive card-punch output from programs operating within the framework of the 1410/7010 Operating System.

**Subprogram:** The basic program element within the Operating System. A subprogram can be a complete program in itself or a program segment (such as a

subroutine) that is to be combined with other program segments to form a complete program.

**System Generator File:** The tape or disk file containing elements of the Operating System, selected from the Master File, which are needed to satisfy the total processing requirements of a specific installation. This file may also contain user-originated subprograms.

**System Library:** A file of relocatable programs created for use under control of the System Monitor.

**System Monitor:** The supervisory program in the 1410/7010 Operating System that calls pre-specified programs or routines into core storage as required. The System Monitor, which operates in accordance with control information supplied by the user, provides Compile-and-Go and Batch Processing capabilities.

**System Operating File:** A tape or disk file, created by the user from the System Generator File, containing absolute programs including the System Monitor, which satisfy the particular processing needs of an installation. This file, if on tape, may also contain the System Library.

## General Description of the 1410/7010 Operating System

The fundamental purpose underlying the development of the 1410/7010 Operating System is the maximum utilization of programmer time, machine time and machine-operator time. Time savings are achieved by means of 1410/7010 programming systems, service programs, and the 1410/7010 System Monitor. Each of these is discussed below in general terms. More detailed descriptions of the various components of the 1410/7010 Operating System are provided later in this section.

### PROGRAMMING SYSTEMS

A programming system consists of a language and its associated processor. The programming systems available with the 1410/7010 Operating System are Autocoder, COBOL and FORTRAN.

Use of the Autocoder, COBOL, or FORTRAN languages reduces the time required by programmers to write and debug programs. The writing of source programs is simplified and thereby speeded up solely as the result of the symbolic nature of these languages. The ability to use a single source language instruction or statement to produce several machine-language instructions further reduces programming time.

A great deal of debugging time is saved because many groups of instructions in the object program are generated by the language processors, and have been pre-tested and debugged. These groups of instructions result from Autocoder macro-instructions, and from COBOL and FORTRAN statements.

### SERVICE PROGRAMS

Service programs provided in the 1410/7010 Operating System are collections of pre-written routines that will perform specific functions in accordance with control information supplied by the user. Some programs in this category function independently, while others are designed for use in conjunction with a user's program. The service programs include the Tape Sorting Program, the Input/Output Control System, the System Generation Program, the Tele-Processing Supervisor, and the four 1410/7010 Utility Programs: Snapshot, Storage Print, Tape Print and 1301 Print.

Use of the service programs to perform various functions required by an installation conserves many hours of valuable programming time. Each service program is designed to perform its function efficiently, making maximum use of an installation's specific machine configuration. Each routine of every program has been thoroughly pre-tested.

### SYSTEM MONITOR

Basic features provided by the System Monitor (see "Definition of Terms") are maximum utilization of

machine time and improved communication between programming and machine-room personnel. Through its "Compile-and-Go" and "Batch Processing" capabilities, the System Monitor substantially reduces the time between runs when the computer is inoperative. By providing simplified and standard operating procedures to be followed, communication between programming and machine-room personnel is greatly improved.

The System Monitor works in conjunction with several other elements of the 1410/7010 Operating System. A number of those elements (such as IOCS and Linkage Loader) are contained within the structure of the System Monitor, thereby eliminating the need for the user to include those elements in his own program.

More details on the structure and features of the System Monitor are included in this section under the heading, "Using the Operating System."

### Autocoder

The Autocoder programming system provides users of the 1410/7010 Operating System with a convenient and efficient means of writing programs. Features provided in the Autocoder language and processor not only simplify the task of writing source programs, but also facilitate the running and debugging of object programs. Among these features are the following:

1. Mnemonic Operation Codes
2. Label Processing
3. Macro System
4. Relocatable Object Programs
5. Assembly Listings

*Mnemonic Operation Codes:* The operation codes in the Autocoder language have a mnemonic relationship to the machine instructions with which they are associated, thereby greatly simplifying the task of the programmer who would otherwise be required to work with the abstract language of the computer. For example, the mnemonic operation code "M" is easier for a programmer to remember and associate with the operation "Multiply" than its machine-language equivalent, "@".

*Label Processing:* Another symbolic feature of Autocoder is the facility for assigning a name or "label" to a specific location or area in core storage, and referring to that label thereafter, rather than to the actual core-storage address. By assigning a label to a data field that is easily associated with the data it contains (such as ITEM, SALARY, DATE) or to a routine that is easily associated with the function performed by that

routine (such as PROCESS, ERRORCHECK, etc.) a programmer can impart to his program a structural clarity and ease of reference that is impossible in machine-language coding.

**Macro System:** The Autocoder Macro System provides facilities for the creation and processing of macro-instructions. A macro-instruction permits the programmer to specify, in one instruction, a series of related operations to be performed. Macro-instructions are translated by the Autocoder processor into the machine-language instructions required to perform the indicated operations. These macro-instructions are contained in a "macro-library," contained within the System Operating File. There are two advantages in the use of macro-instructions as opposed to "one-for-one" symbolic instructions. First, macro-instructions permit use of the symbolic features of a language (mnemonic operation codes and label processing) at a higher level. Second, they permit the user to write his program by describing the *functions* he wants performed rather than by describing the *operations* necessary to perform those functions. In other words, a macro-instruction is used to specify *what* function is to be performed, and will result in a series of instructions that specify *how* that function is to be performed.

**Relocatable Object Programs:** Object programs produced by the Autocoder processor are in relocatable format. This format offers two advantages. First, it permits the program to be loaded into any available area of core storage during batch processing. Second, it permits independently compiled programs to refer to locations in other programs. These references are then linked when the programs are combined during batch processing.

**Assembly Listings:** Assembly listings are produced for all programs compiled by the Autocoder processor. These listings show the source program relation to the object program. Labels are related to core-storage assignments, symbolic instructions to their machine-language equivalents, etc. The listing is arranged in a format that permits ease of reference. In addition, coding errors detected by the processor are indicated in the listing, making it an invaluable aid in program debugging.

## **COBOL**

The COBOL programming system enables users of the 1410/7010 Operating System to create business-oriented object programs with a minimum of programmer effort. COBOL (COmmon Business Oriented Language) source programs are written in a language similar to ordinary business English, thereby permitting the user to associate his program more directly with the related problem.

COBOL provides all the advantages of any symbolic language, such as Autocoder, plus the additional advantages inherent in a "higher-level" language. The majority of words in the vocabulary of a higher-level language such as COBOL are at least the equivalent of a macro-instruction with relation to the number of machine-language instructions produced. Therefore, if COBOL is appropriate for a particular problem, its use can result in the creation of an object program with a minimum of programmer time and effort.

The 1410/7010 COBOL processor will compile source language programs directly into machine-language, bypassing the intermediate stage of a lower-level symbolic language program common to many COBOL processors. This "direct translation" method results in a significant reduction in compilation time.

Object programs produced by the 1410/7010 COBOL processor will be in relocatable format. This format permits FORTRAN-compiled and/or Autocoder-compiled subroutines to be incorporated into an independently compiled COBOL program at object time.

## **FORTRAN**

The FORTRAN programming system enables users of the 1410/7010 Operating System to create programs for scientific problems with a minimum of programmer effort. FORTRAN (FORmula TRANslator language) source programs are written in a language containing terminology similar to mathematics, thereby permitting the user to associate his program more directly with the related problem.

The FORTRAN programming system offers a "higher-level" language and provides macro-instruction facilities. It offers a processor that compiles source programs directly into relocatable machine-language programs.

The 1410/7010 FORTRAN source programs can be written for use independently or as subprograms, i.e., programs that can be combined for execution as a unit with other programs. Subprograms can contain references to labels in other subprograms, and these will be linked when the subprograms are combined at object time.

## **Input/Output Control System**

The 1410/7010 Input/Output Control System (IOCS) is a set of pre-written routines that will perform all input/output functions for an object program. Among these functions are scheduling of read and write operations, error detection and correction, end-of-file handling, checkpoint and restart facilities, and blocking and deblocking of records.

The 1410/7010 IOCS is provided as part of the 1410/7010 Operating System. Included are macro-instruction

facilities for unit-record equipment, magnetic tape units, 1301 Disk Storage, the 1414 Input/Output Synchronizer, and the 7750 Programmed Transmission Control. Routines for disk storage permit both random and sequential processing. Random processing is controlled within IOCS by the Random-Processing Scheduler. Routines for Tele-Processing equipment, i.e., the 1414 and 7750, work in conjunction with the Tele-Processing Supervisor.

When the user defines his machine configuration during System Generation, only those IOCS routines he will require become part of the System Monitor section of his System Operating File. The IOCS resides in core storage when programs are being executed.

Macro-instructions provided for use with the IOCS are of two types: one type results in linkages to routines within the IOCS; the other type results in generated routines within the user's programs.

Input/output functions required by component programs of the 1410/7010 Operating System are performed by the IOCS. Programs written by the user for operation within the framework of the Operating System must also use the IOCS.

### **The Tele-Processing Supervisor**

The Tele-Processing Supervisor is an optional component of the 1410/7010 Operating System available to 1410 or 7010 installations with Tele-Processing devices. Like the Input/Output Control System, the Tele-Processing Supervisor becomes part of the System Monitor at System Generation. The organization and size of the Supervisor is determined by the user's configuration of telecommunications devices.

The Supervisor works in conjunction with the IOCS and various programs provided by the user to handle all input/output functions for telecommunications devices. Its primary function is to supervise the flow within the 1410 or 7010 of data received from or scheduled for telecommunications devices, and to transfer control, when necessary, to appropriate routines within the System Monitor or the user's program(s).

The System Monitor will sometimes write messages on the console printer during batch processing. Because of the high priority generally accorded data from telecommunications devices within an installation, *it is suggested that these devices be attached to channel 2 of the 1410 or 7010*, in order to permit interrupts from these devices when the console printer is in use on channel 1.

### **Tape Sorting Program**

The 1410/7010 Generalized Tape Sorting Program consists of a set of pre-written routines provided in

relocatable form on the Master File (see "Definition of Terms"). It also contains a "sort definition" program that is similar to a compiler. This program provides the user with the facility for creating a sorting program for specific tape files during System Generation or during batch processing. In other words, the user can maintain a file of sorting programs in absolute format, and at the same time retain the facility for creating additional absolute sorting programs at object time by means of the sort definition program on the System Operating File. The absolute sorting programs operate in accordance with control information specified by the user.

The 1410/7010 Generalized Tape Sorting Program operates in conjunction with the IOCS and other components of the System Monitor. It has the ability to sort or merge, data records on tape in ascending or descending sequence. It will handle fixed-length or variable-length records, and can include linkages to specialized routines written by the user.

### **Utility Programs**

A set of four utility programs are provided with the 1410/7010 Operating System: Snapshot, Storage Print, Tape Print and 1301 Print. Output from these programs is obtained on the Standard Print Unit. All four programs use a standard scheme of abbreviation for nonprintable characters.

**Snapshot:** The Snapshot utility program will print all or selected areas of core storage at intervals specified by the user. The Snapshot program can be combined with the user's program by the System Monitor. Information will be printed as it appears in core storage, with word marks indicated above the appropriate characters. The settings of various indicators and registers will also be listed.

**Storage Print:** The Storage Print utility program will print all or selected areas of core storage in accordance with control information provided by the user. Unlike the Snapshot program, it will be executed only when specifically requested at object time by user-supplied control cards. The printed listing is provided in machine language. Word marks will be indicated where they appear in core storage. Settings of various indicators and registers will also appear in the printed listing.

**Tape Print:** The Tape Print utility program will print all or a portion of the contents of a tape. Tape Print will print the contents of one or more files, or a specified number of data records within a file. Records can be on tape in fixed-length or variable-length format, and in odd or even parity. Printed listings can show word separator characters as separate characters or as word

marks above the appropriate characters. An end-of-file message will be printed after each complete file. Tape identification, mode, and parity will be indicated; data record and character counts will be made.

**1301 Print:** The 1301 Print utility program will print all or selected areas of 1301 Disk Storage. Data to be printed can be in disk storage in either the Move mode or Load mode, and will be written out in the Full Track mode of operation.

### System Generation

Optional and required components of the 1410/7010 Operating System provided by IBM are combined by the user to create a specific operating system for his own installation. This process is called System Generation. The basic file in the user's operating system is the System Generator File (see "Definition of Terms"). One or more System Operating Files can be created for use within an installation from the System Generator File.

The 1410/7010 Operating System is made available to users on a reel of tape which becomes the Master File for the installation. This Master File will be made up for use with a tape-oriented system or a disk-oriented system, whichever is specified. From this tape, the user creates a System Generator File for his installation. The System Generator File is then used to create specific System Operating Files in accordance with control information provided by the user. An installation's System Operating Files can include relocatable and absolute programs supplied by the user, in addition to the required and optional components of the Operating System supplied by IBM.

In addition to creating one or more System Operating Files, System Generation can include the creation of a System Library File (see "Definition of Terms"). System Generation routines can also be used to update the SGF, to update SOF's and System Libraries, and to print a listing of the elements contained on the gen-

erated SOF(s). A detailed listing of the contents of the Macro Library may also be printed. System Operating Files can be created for use on tape or in 1301 Disk Storage. Figure 2 depicts the general flow of data during the creation of an operating system. It is not a complete chart, and is shown only to facilitate a basic understanding of System Generation.

### Using the Operating System

Once an operating system has been created for use by an installation, compilations of source programs and the testing and execution of object programs can be performed under control of the System Monitor, provided the necessary components of the operating system are available. For example, the COBOL processor must be included on the SOF if a COBOL source program is to be assembled.

The System Monitor is the heart of an operating system. It performs such major functions as the assignment of input/output units, program loading and relocation, and the linkage of independently compiled programs. It also provides batch processing and compile-and-go capabilities.

The System Monitor contains three major elements: the Resident Monitor, the Transitional Monitor, and the Linkage Loader.

The Resident Monitor consists of control routines that remain in core storage while the operating system is functioning. It includes the operating system's IOCS, input/output assignment routines, end-of-program routines, an absolute-program loader, and other frequently used routines. In a Tele-Processing System, the Tele-Processing Supervisor is part of the Resident Monitor. The Transitional Monitor contains routines required to permit transition from run to run and from one job to the next during batch processing. The Linkage Loader performs the functions required to convert relocatable programs into absolute programs for execution. The Transitional Monitor and the Linkage Loader are called into core storage when required.

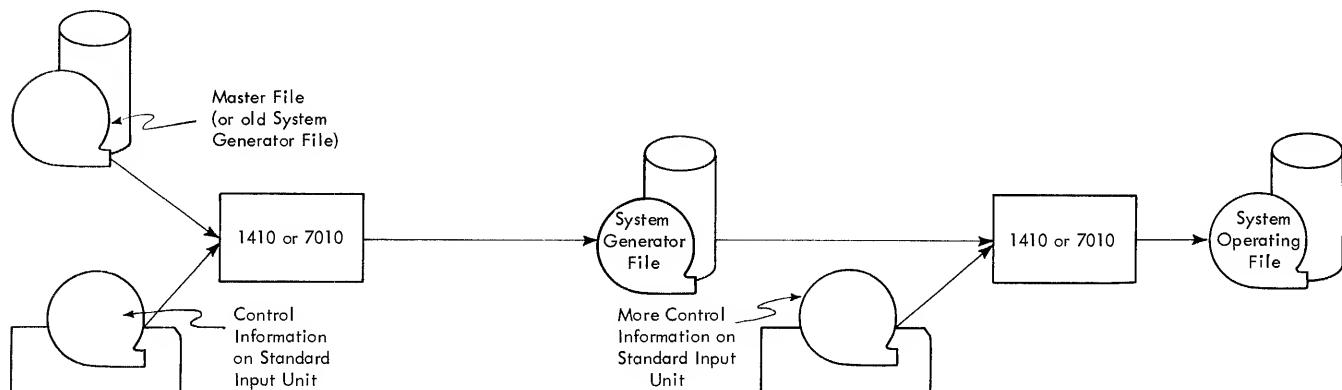


Figure 2. System Generation, General Data Flow

All jobs to be performed in an operating system are controlled by the System Monitor in accordance with instructions provided by the user via control information in the Standard Input Unit. A sample batch of three jobs is described, along with a diagram of the required control card information (Figure 3). Machine configuration diagrams for the three jobs are shown in Figures 4, 5 and 6.

The functions performed by the various control cards

are described in the publication, *System Monitor*, as are the files depicted in the configuration diagrams. Neither the control card diagram nor the machine configuration diagrams should be considered complete. They are provided merely to facilitate a basic understanding of the structure, use and operation of an operating system. Optional input/output units shown in Figures 4, 5 and 6 can be included in an operating system, but are not required for the sample program.

## Sample Batch

- Job 1:* Load and execute absolute program A (PGMA) from SOF.
- Job 2:* Combine and execute relocatable subprograms B and C (PGMB and PGMC). Subprogram B is located in the System Library (contained on a unit other than the SOF); subprogram C is located in the Standard Input Unit.
- Job 3:* Compile Autocoder source program D (PGMD) from Standard Input Unit; combine object program D with relocatable subprograms E and F (PGME and PGMF in System Library File), and execute combined program.

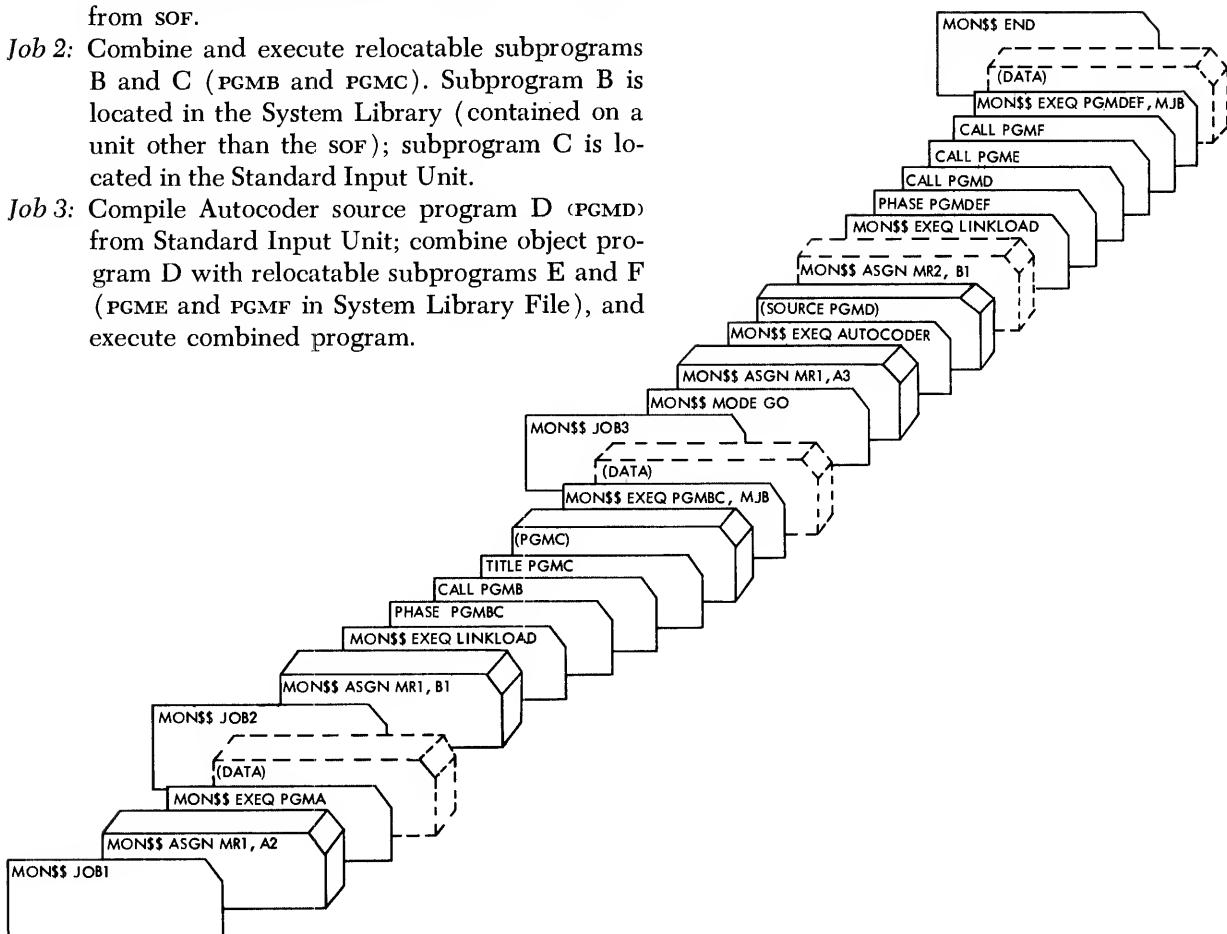


Figure 3. Sample Program Batch

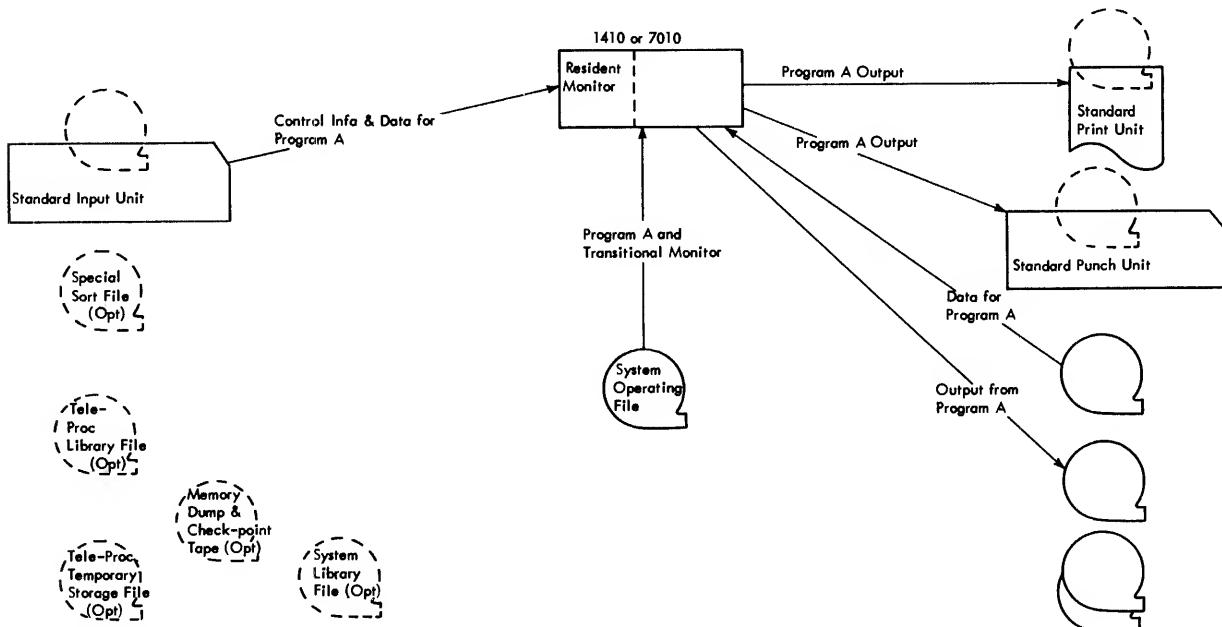


Figure 4. JOB 1

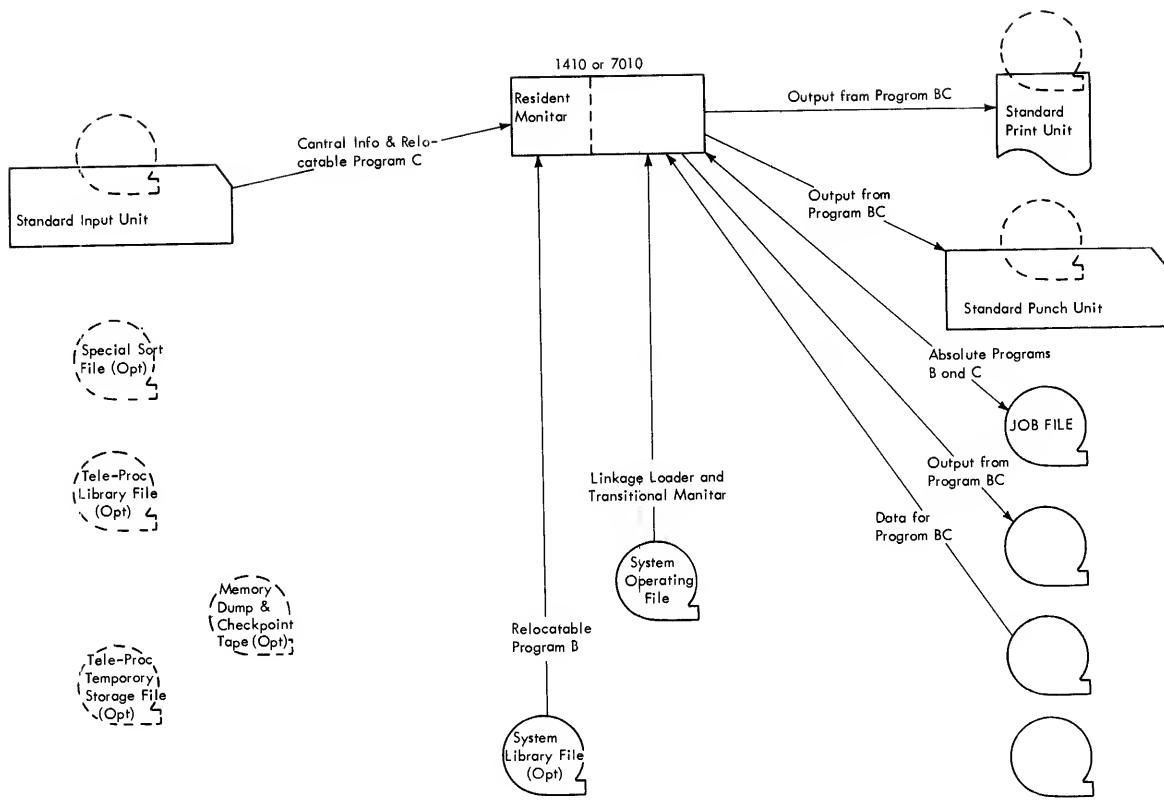


Figure 5. JOB 2

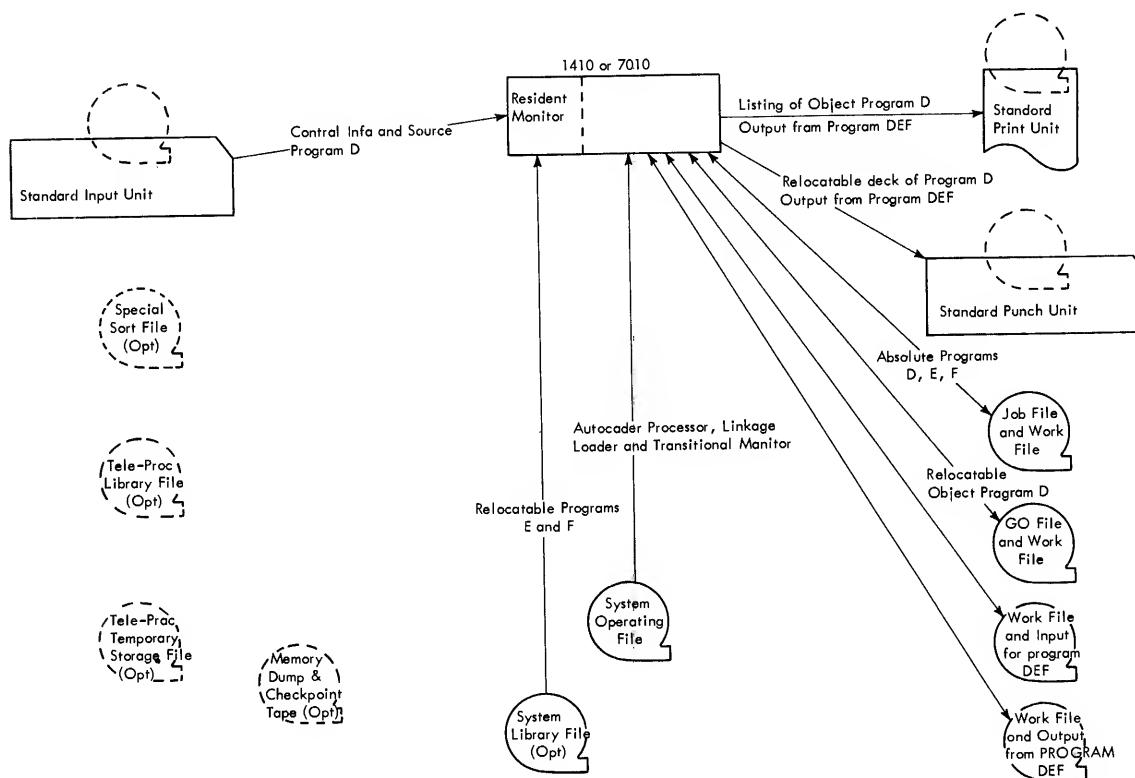


Figure 6. JOB 3

# 1410/7010 Operating System Publications

An integrated set of publications describing the various components of the 1410/7010 Operating System is available to users of the 1410 or 7010 Data Processing Systems. The relationship between these publications is shown in the configuration chart, Figure 7. Referring to the chart, note that the Basic Concepts publication is prerequisite to all other publications in the set. Following a solid-line path from the Basic Concepts publication to any other publication will indicate the chain of reading *prerequisite* to that publication. The dotted lines are used to complete a *recommended* sequence of reading. For example, the Basic Concepts and System Monitor publications are pre-

requisites to the Generalized Tape Sorting Program publication. However, it is recommended that the Autocoder and Basic IOCS publications also be read before proceeding to the Tape Sorting publication. The individual publications provide cross references to other publications in the set, where required.

A brief description of each of the publications is provided in the remainder of this section.

## Basic Concepts

The purpose of this publication is described in the Introduction.

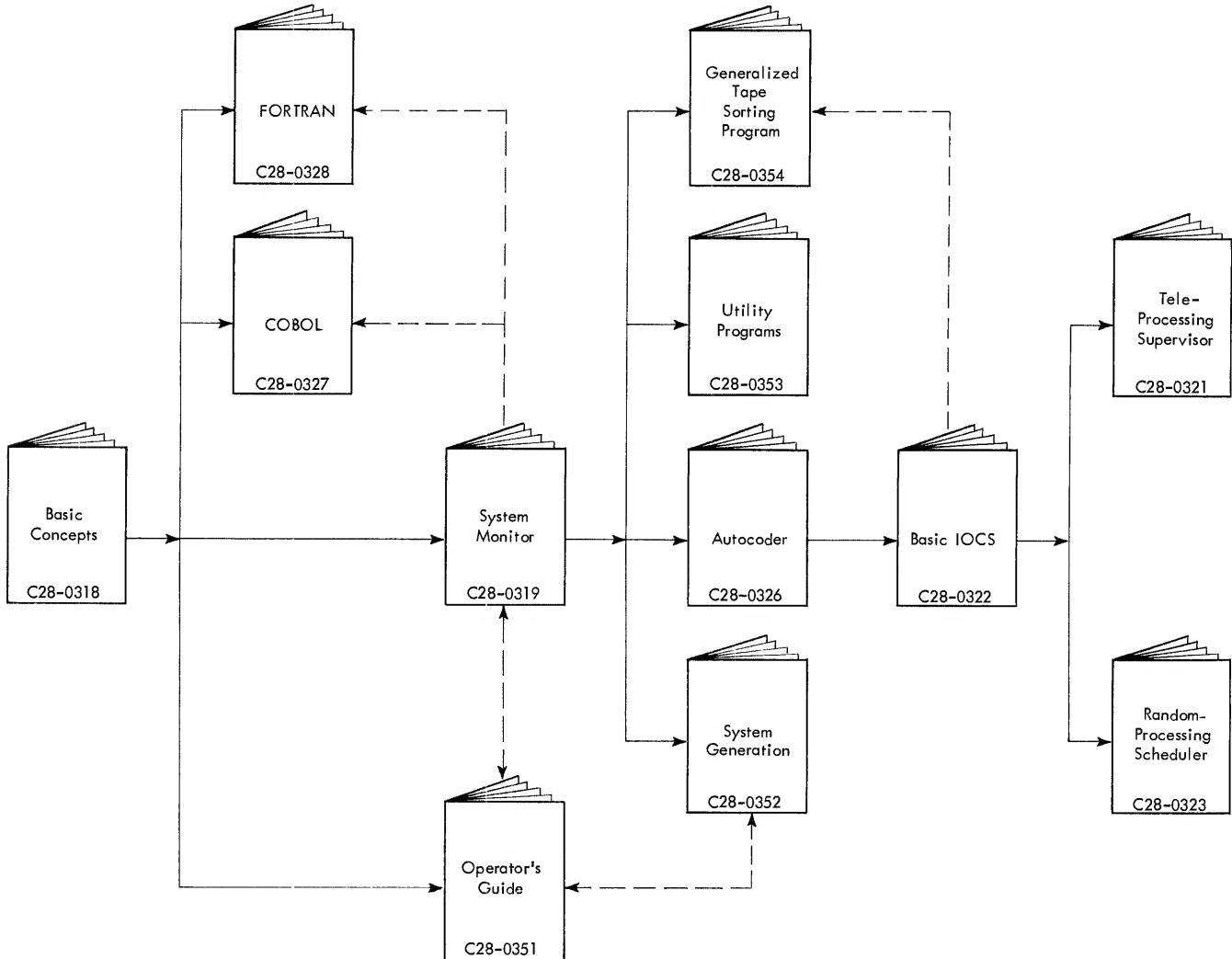


Figure 7. 1410/7010 Operating System Publications

### **System Monitor**

This publication provides programmers and systems analysts with the basic principles and programming requirements for the System Monitor. The programming information given includes the control cards required, the linkage sequences to Monitor routines and data fields, the messages produced by the Monitor, and the console inquiries accepted.

The System Monitor provides control for the IBM 1410/7010 Operating System by furnishing programmed transition between runs and between jobs; relocating programs, and assigning input/output units. The System Monitor consists of the Resident and Transitional Monitors—1410-SV-962, and the Linkage Loader—1410-UT-963.

### **System Generation — 1410-MI-965**

This publication provides programmers and systems analysts with specifications of the system generation functions to be performed by the 1410/7010 Operating System, and a description of the general requirements for implementing these functions. Included are discussions of the basic routines that perform the system generation functions.

### **Basic Input/Output Control System — 1410-IO-966**

This publication provides 1410 and 7010 programmers with the information needed to write efficient programs incorporating the Basic Input/Output Control System.

The Basic Input/Output Control System, an integral part of the IBM 1410/7010 Operating System, can schedule, implement and control the transfer of data to and from core storage. It can also perform functions related to the transfer of data, such as error detection and correction.

Included in this publication are detailed descriptions of the DTF (Define the File) statements, the Basic Input/Output Control System macro-instructions, disk file processing using the Basic Input/Output Control System, and certain aspects of the internal operation of IOCS that will enable the programmer to take full advantage of the flexibility of IOCS.

### **Tele-Processing Supervisor — 1410-SV-964**

This publication contains the specifications of the Tele-Processing Supervisor, and is a supplement to the publication, *IBM 1410/7010 Operating System; System Monitor*, Form C28-0319.

The Tele-Processing Supervisor, which is generated as part of the System Monitor for the 1410/7010 Operating System, provides control facilities for programs written by an installation to process input/

output for the Tele-Processing devices. Information in this publication includes a description of the basic principles of the Tele-Processing Supervisor, instructions for writing programs to operate under its control, and a discussion of the program elements that can be selected during System Generation to create a Tele-Processing Supervisor tailored to the requirements of each installation.

### **Random-Processing Scheduler — 1410-IO-967**

This publication is a reference text for use of the Random-Processing Scheduler, an optional component of the IBM 1410/7010 Operating System. Providing facilities for the efficient handling of input/output operations in random-processing applications, the Random-Processing Scheduler augments the Basic Input/Output Control System component of the Operating System. The manual discusses the random-processing concepts applicable to the Random-Processing Scheduler, and provides detailed information concerning the macro-instructions, Define the File statements, and Define Area statements associated with the Random-Processing Scheduler.

This material is intended for use by programmers and systems analysts who have knowledge of the Basic Input/Output Control System and the IBM 1410/7010 Autocoder language.

### **Utility Programs — 1410-UT-973**

This publication provides programmers and systems analysts with a description of the functions performed by the IBM 1410/7010 Operating System Utility Programs, and the requirements for their use. These programs permit the user to obtain printed listings of all or part of core storage, magnetic tape storage, and IBM 1301 Disk Storage. The reader of this publication must be familiar with the concepts and use of the System Monitor.

### **Generalized Tape Sorting Program — 1410-SM-971**

The Generalized Tape Sorting Program consists of a set of relocatable routines and a separate routine called the Sort Definition program. This publication provides the 1410/7010 Operating System user with the detailed information necessary for implementation of this program.

In addition to providing general information on the program, and data on its features and specifications, this publication describes the nature of the Sort Definition program, the control cards used to form a Sort or Merge program, how the program is self-modified via control cards at object time to fit the particular application, and how the user includes his own programming to perform modifications to the program.

### **Autocoder**

This publication is a reference text for personnel engaged in writing programs in the Autocoder language for use within the framework of the 1410/7010 Operating System. This publication should be read to the extent the user feels necessary to become familiar with the concepts presented; thereafter it should be used as a reference manual.

The Autocoder language is composed primarily of symbolic one-for-one source statements. Its associated processor (1410-AU-968) is a symbolic assembly program with macro-generation facilities.

It is assumed that the user has completed a basic course in programming for the IBM 1410 or IBM 7010 Data Processing System.

### **COBOL**

This publication is designed to be used by programmers in conjunction with the publication, *IBM General Information Manual, COBOL*, Form F28-8053, and contains additional specifications required to write COBOL programs to be processed under the 1410/7010 Operating System.

The similarity between COBOL and ordinary business English provides programmers with a convenient method for writing source programs. Source program statements are translated directly into machine language by the COBOL compiler (1410-CB-969), which

takes full advantage of the capabilities of the IBM 1410 and 7010 Data Processing Systems.

### **FORTRAN**

The IBM 1410/7010 FORTRAN language with its associated processor in the 1410/7010 Operating System provides the user with a convenient method of producing programs that will perform efficient scientific computation and data handling. FORTRAN source programs are written in a language similar to mathematics. The processor (1410-FO-970) compiles the source program directly into machine language in relocatable format.

This publication describes the various types of arithmetic, control, input/output, subprogram, and specification statements that are accepted by the processor, and the programming rules for their use.

### **Operator's Guide**

This publication provides operating personnel with the machine-room operating requirements of the IBM 1410/7010 Operating System. The information given includes procedures for System Generation, initialization, reinitialization, and restarting the Operating System; arrangement of control card decks; assignment of input/output units; use of the tape-to-printer program; use of console inquiries; and actions required in response to console messages from the system.

Reader's Comments

IBM 1410/7010 Operating System (1410-PR-155)  
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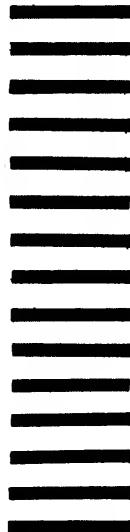
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